Energy Self-Assessment Tools and Energy Audits for Water and Wastewater Utilities

James Horne, US EPA Office of Wastewater Management

Jason Turgeon, US EPA Region 1

Eric Byous, US EPA Region 9

Guide to Our Webcasts

- To Ask a Question – Type your question in the text box located at the bottom of your screen
- To Answer Poll Question – Click on the radio button to the left of your choice and click submit. Do not type your answer in the “Ask a Question” box
- To See Closed Captioning – Turn your pop-up blocker off and click on the “closed captioning” button
- To Complete the Evaluation – Answer questions in the slide window

Energy Use and Water Utilities

- Water and Wastewater treatment represents about 3% of the nation's energy consumption
  - About $4 billion is spent annually for energy costs to run drinking water and wastewater utilities
  - Equivalent to approximately 56 billion kilowatt hours (kWh)
  - Equates to adding approximately 45 million tons of greenhouse gas to the atmosphere
- Energy represents the largest controllable cost of providing water or wastewater services to the public
  - Over 16,000 municipal treatment plants in the US and over 50,000 community water systems
  - For wastewater, energy represents 25-30% of the total plant O&M
    - raw sewage pumping (12%), Aeration (25%), solid handling (30%), lighting, heating, AC and other (6%)
  - As energy costs rise, operating costs rise

Energy Reduction at Water Utilities

- Water and Energy Efficiency at Utilities =
  - Reduced energy usage
  - Reduced operating costs
  - Reduced climate impacts/carbon footprint
  - Sustainability of water infrastructure
  - Save Water

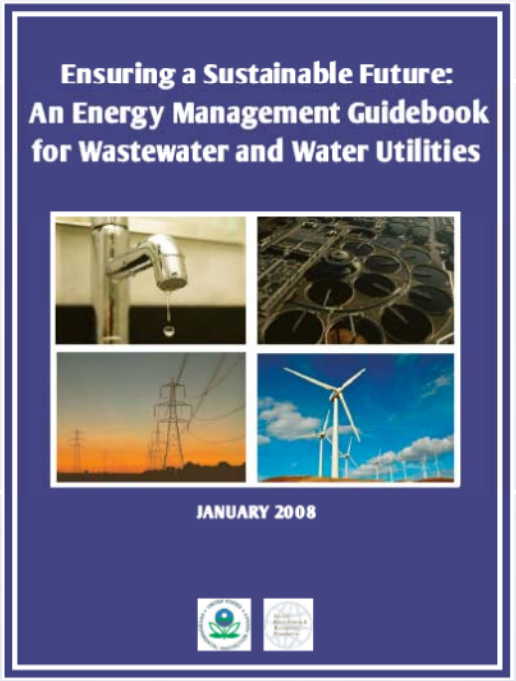
Why Focus on Management?

- Energy issues are here to stay and will only get more serious—no quick fixes!
- Individual projects and technologies are fine, but something is needed to pull it all together (a **system**)
- Systematic management will ensure **continuing** focus on energy efficiency
- The Plan-Do-Check-Act management systems approach has worked in many different sectors

Managing to Maximize Energy Efficiency

Designed to help utilities:

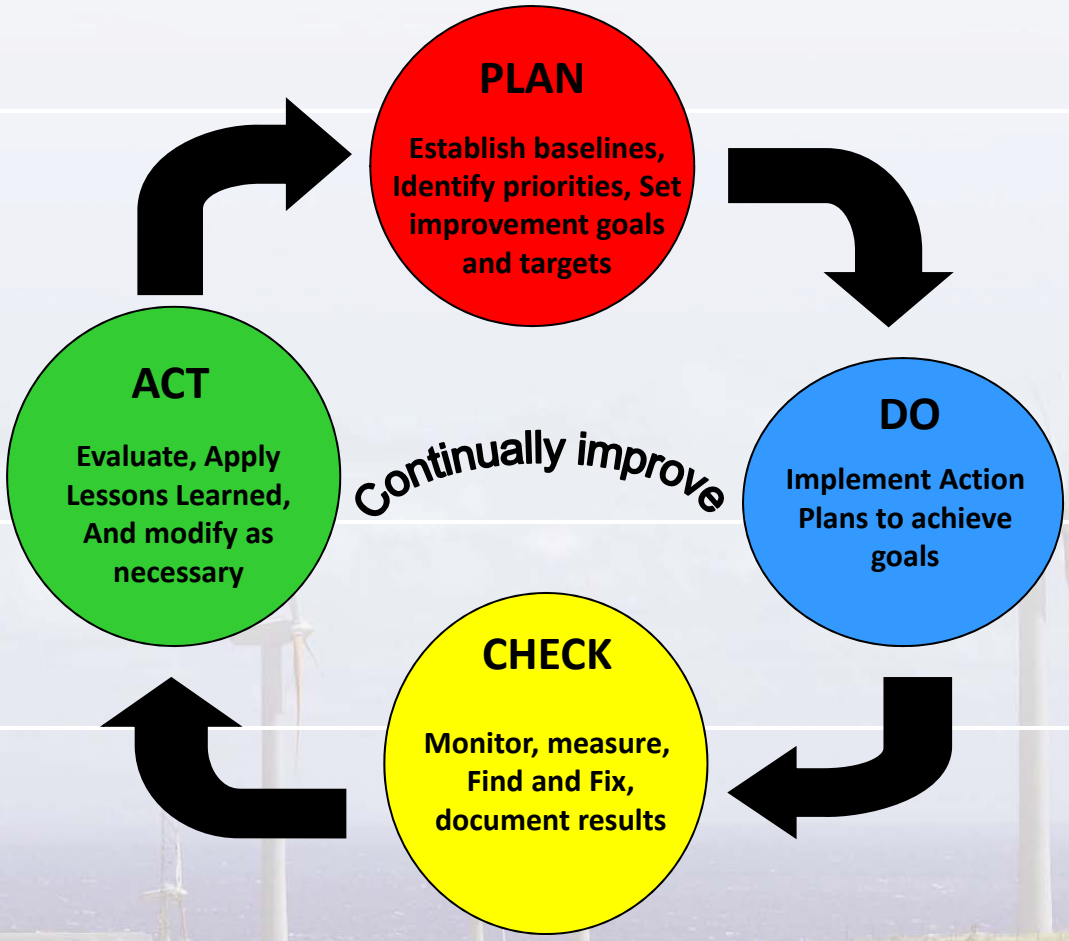
- Systematically assess current energy costs and practices
- Set measurable performance improvement goals
- Monitor and measure progress over time



Uses a management system approach for energy conservation, based on the successful Plan-Do-Check- Act process [based on Environmental Management Systems (EMS)

http://water.epa.gov/infrastructure/sustain/cut_energy.cfm

The Plan-Do-Check-Act Approach



- Allows utilities to systematically assess and manage energy opportunities and take action
- NOT a project—a system to manage for the long haul

Section 1: Self-Assessment Tools

- Free
- Easy to Use for Operators of Any Size
- Available Online
- Do Not Require Outside Assistance

EPA Energy Self-Assessment Tools

- ENERGY STAR Portfolio Manager
  - Water/Wastewater Utilities
- EPA Office of Groundwater and Drinking Water Energy Use Assessment Tool
- EPA Energy Management Planning Self-Assessment worksheet (aka “radar graph”)

Non-EPA Energy Self-Assessment Tools

- NYSERDA Water and Wastewater Focus Program
  - Wastewater Benchmarking Tool
  - Water and Wastewater Self-Audit checklists
- CEE Water and Wastewater Self-Audit Checklists
  - Available via Partner Websites (e.g., Efficiency Vermont)
- WERF Carbon Heat Energy Analysis Plant Evaluation Tool (CHEApet)
  - For WERF members only
- Mass Energy Insight
  - (available to local governments in Massachusetts)

EPA Portfolio Manager

www.energystar.gov/benchmark

Benchmarking

- Expanding EPA's Energy Performance Scoring System for use by water and wastewater utilities to rate energy performance
  - Accessed on-line through Portfolio Manager
  - Performance score for wastewater treatment plants
    - based on energy use per unit of flow, influent and effluent quality, treatment type
  - Normalized for external factors
  - Wastewater—Resulting model shows statistical significance at 90% confidence level
- Engine behind the energy performance scale
  - Water Research Foundation (WRF – previously AwwaRF) Project—National Survey Data: covers water and wastewater
  - Initial models developed—report published by WRF in 2007 (project no. 2009), available free to subscribers online at http://www.waterresearchfoundation.org/

Group Averages	
Baseline Rating: N/A Facilities Included: 0	**Current Rating: N/A** Facilities Included: 0
Change from Baseline: Group Adjusted Percent Energy Use (%): N/A Facilities Included: 0	
Averages are weighted by Total Floor Space. More about Baselines More about Change from Baseline: Adjusted Energy Use	
Group Averages **(for all Water Utilities and Wastewater Treatment Facilities)**	
Baseline Rating: 87 Facilities Included: 3	**Current Rating: 91** Facilities Included: 3
Change from Baseline: Group Adjusted Percent Energy Use (%): -14.4% Facilities Included: 3	
Averages are weighted by Average Daily Flow. More about Wastewater	

Add a Property
Import Facility Data Using Templates

Work with Facilities
Update Multiple Meters
Share Facilities

Reporting and Analysis
New! Generate Reports and Graphs
Request Energy Performance Report
Federal Sustainability Report

Apply for Recognition
Apply for the ENERGY STAR
ENERGY STAR Leaders

Automated Benchmarking
Get Started Now

My Facilities | My Campuses

GROUP: Sample Facilities | Create Group | Edit Group | View All

VIEW: Wastewater energy | Create View | Edit View | View All

Download in Excel

Search Facility Name: Search

Results 1 - 3 of 3

All # A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

Facility Name	Current Rating (1-100)	Average Flow (MGD)	Current Source Energy per Flow (kBtu/gpd)	National Average Source EUI (kBtu/gpd)	Current Total Site Energy Use (kBtu)	Current Site Electric Use (kWh)	Current Energy Period Ending Date
Wastewater Example Facility	85	3.0	5.8479	9.5	6,905,407.55	1,307,400.0	12/31/2006
Wastewater Example Facility 2	92	3.0	4.9503	9.6	6,072,074.93	1,077,960.0	11/30/2006
Wastewater Example Facility 3	97	3.0	3.8249	9.5	4,594,917.55	845,180.0	12/31/2006

Download in Excel

Search Facility Name: Search

Results 1 - 3 of 3

All # A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

The rating is calculated by using the last day of the latest full calendar month where all meters in the facility have meter entries; the Period Ending date reflects that particular date.

PORTFOLIO MANAGER

ACCOUNT INFORMATION | CONTACTS | FREQUENTLY ASKED QUESTIONS | CONTACT US | HELP | LOGOUT

Home > My Portfolio

Group Averages	
Baseline Rating: N/A Facilities Included: 0	**Current Rating: N/A** Facilities Included: 0
Change from Baseline: Group Adjusted Percent Energy Use (%): N/A Facilities Included: 0	
Averages are weighted by Total Floor Space. More about Baselines More about Change from Baseline: Adjusted Energy Use	
Group Averages **(for all Water Utilities and Wastewater Treatment Facilities)**	
Baseline Rating: 87 Facilities Included: 3	**Current Rating: 91** Facilities Included: 3
Change from Baseline: Group Adjusted Percent Energy Use (%): -14.4% Facilities Included: 3	
Averages are weighted by Average Daily Flow. More about Wastewater	

Add a Property
Import Facility Data Using Templates

Work with Facilities
Update Multiple Meters
Share Facilities

Reporting and Analysis
New! Generate Reports and Graphs
Request Energy Performance Report
Federal Sustainability Report

Apply for Recognition
Apply for the ENERGY STAR
ENERGY STAR Leaders

Automated Benchmarking
Get Started Now

My Facilities | My Campuses

GROUP: Sample Facilities | Create Group | Edit Group | View All

VIEW: Performance: GHG Emissions | Create View | Edit View | View All

Download in Excel

Search Facility Name: Search

Results 1 - 3 of 3

All # A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

Facility Name	Current Energy Period Ending Date	Current Total Site Energy Use (kBtu)	Current Direct GHG Emissions (MtCO2e)	Current Indirect GHG Emissions (MtCO2e)	Current Total GHG Emissions (MtCO2e)	Baseline Total GHG Emissions (MtCO2e)	Change from Baseline: GHG Emissions (MtCO2e)
Wastewater Example Facility	12/31/2006	6,905,407.55	179.84	494.68	674.52	747.69	-73.17
Wastewater Example Facility 2	11/30/2006	6,072,074.93	176.13	407.87	583.99	687.15	-103.16
Wastewater Example Facility 3	12/31/2006	4,594,917.55	125.89	319.79	445.68	611.48	-165.80

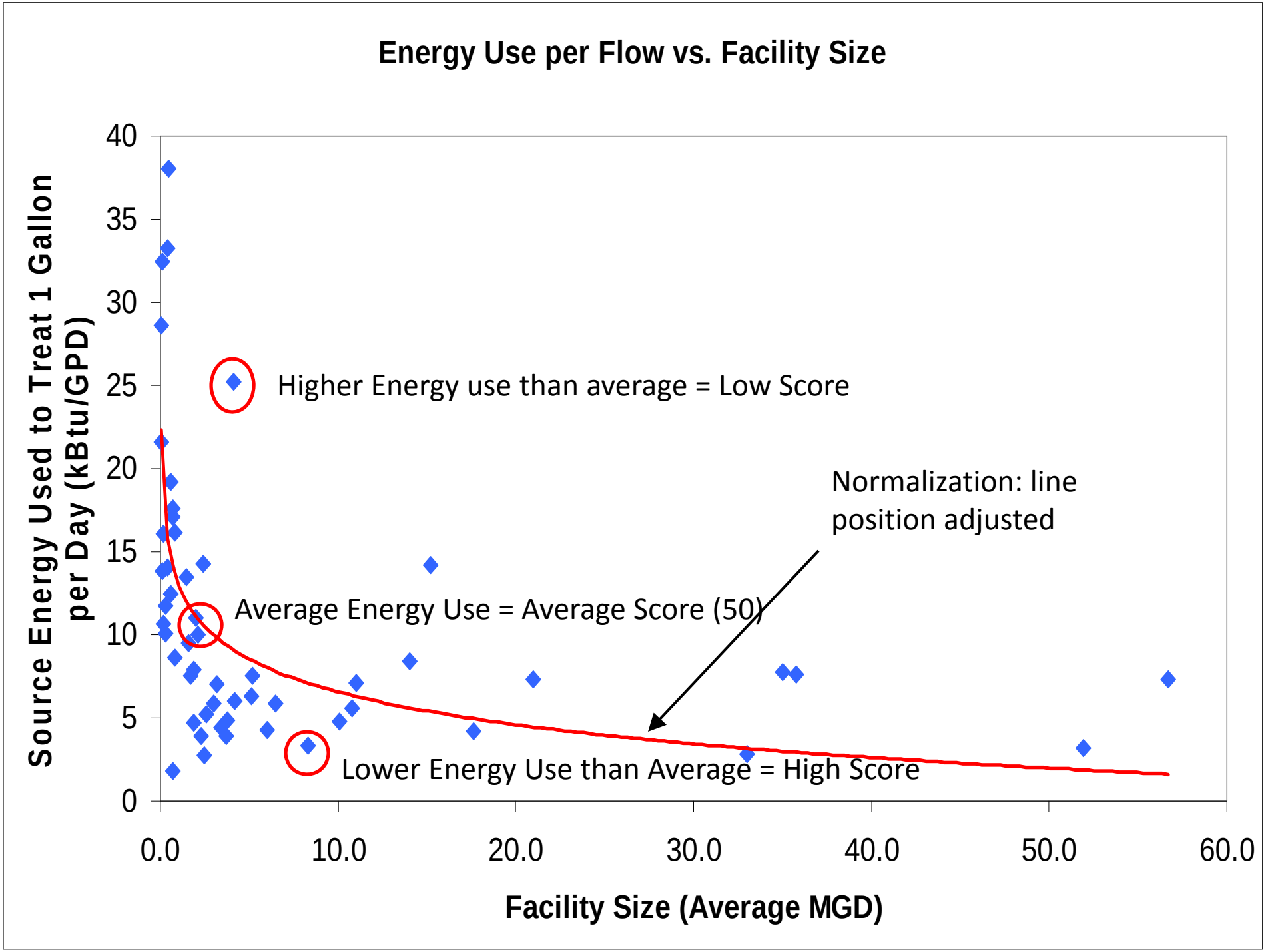
Download in Excel

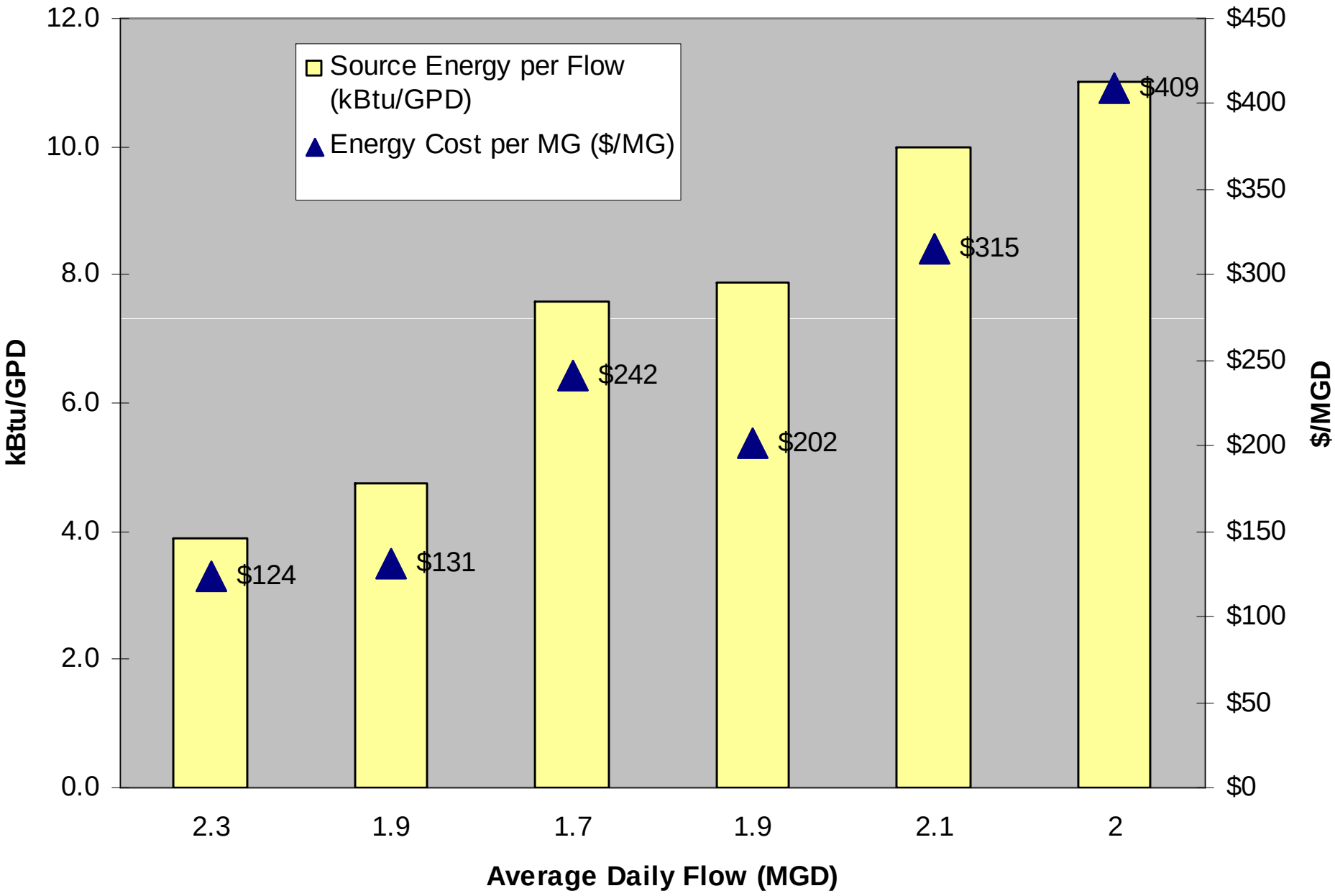
Search Facility Name: Search

Results 1 - 3 of 3

All # A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

The rating is calculated by using the last day of the latest full calendar month where all meters in the facility have meter entries; the Period Ending date reflects that particular date.


Energy Use per Flow vs. Facility Size
Source Energy Used to Treat 1 Gallon per Day (kBtu/GPD)
40
35
30
25
20
15
10
5
0
0.0
10.0
20.0
30.0
40.0
50.0
60.0
Facility Size (Average MGD)
Higher Energy use than average = Low Score
Normalization: line position adjusted
Average Energy Use = Average Score (50)
Lower Energy Use than Average = High Score


Energy Use and Cost vs Flow at similar sized plants
FY 2006 data
Source Energy per Flow (kBtu/GPD)
Energy Cost per MG ($/MG)
kBtu/GPD
$/MGD
12.0
10.0
8.0
6.0
4.0
2.0
0.0
$450
$400
$350
$300
$250
$200
$150
$100
$50
$0
$124
$131
$242
$202
$315
$409
2.3
1.9
1.7
1.9
2.1
2
Average Daily Flow (MGD)

www.energystar.webex.com

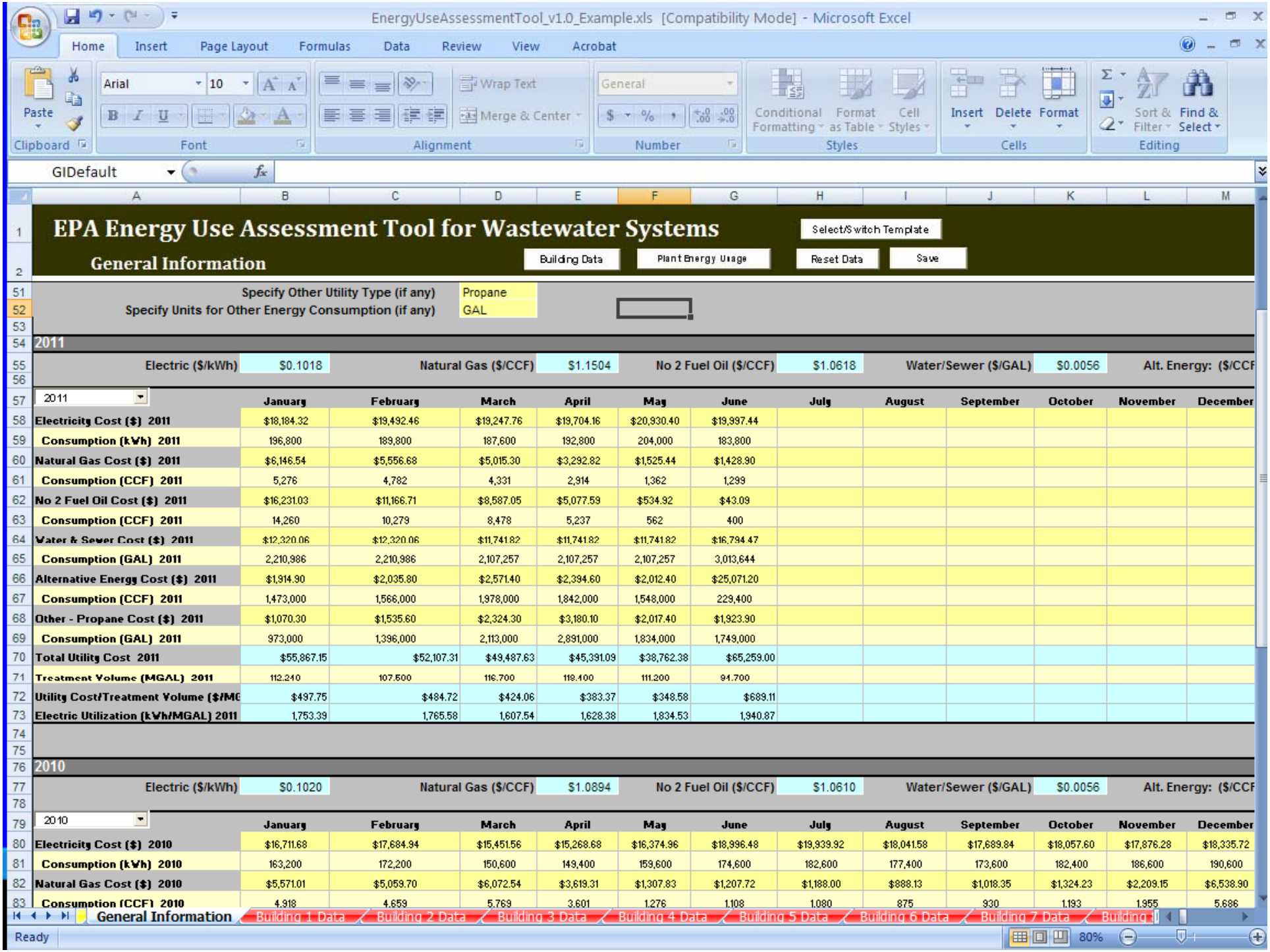
Quarterly Portfolio Manager Webinars

EPA's Energy Use Assessment Tool

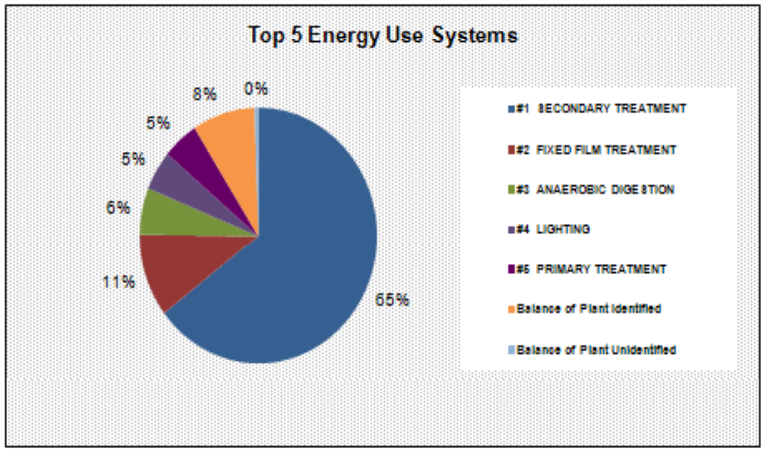
- What is the Energy Use Assessment Tool?
  - Free of charge, downloadable tool based in Excel that can be used by small and medium water and wastewater systems
  - Allows a utility to conduct a utility bill analysis to assess baseline energy use and costs
  - Use prior to a full-scale energy audit
- How is it different than EnergyStar Portfolio Manager?
  - Drills down to equipment level
  - Printable summary report
    - Presentation of energy consumption & costs (broad to detail)
    - Graphs energy use over time
    - Highlights areas of energy efficiency

EPA's Energy Use Assessment Tool

- What information is needed to enter in the Tool?
  - All plant utility data (use and cost information) by month (minimum of 12 months) for up to 5 years of analysis
    - Collect from utility bills such as electric, natural gas, water/sewer, fuel oil, alternative energy, and other utilities
  - Non-process information (by building)
    - List of lighting fixtures
    - HVAC equipment
  - Drinking water and/or Wastewater treatment plant information
    - Monthly treatment/discharge volumes
    - Pump and motor nameplate data (horsepower, efficiency rating, full load amp rating)
    - Average motor operating amperage


EnergyUseAssessmentTool_v1.0_Example.xls [Compatibility Mode] - Microsoft Excel
Home
Insert
Page Layout
Formulas
Data
Review
View
Acrobat
GIDefault
EPA Energy Use Assessment Tool for Wastewater Systems
Select/Switch Template
General Information
Building Data
Plant Energy Usage
Reset Data
Save
Specify Other Utility Type (if any)
Propane
Specify Units for Other Energy Consumption (if any)
GAL
2011
Electric ($/kWh) $0.1018
Natural Gas ($/CCF) $1.1504
No 2 Fuel Oil ($/CCF) $1.0618
Water/Sewer ($/GAL) $0.0056
Alt. Energy: ($/CCF
2011
January February March April May June July August September October November December
Electricity Cost ($) 2011 $18,184.32 $19,492.46 $19,247.76 $19,704.16 $20,930.40 $19,997.44
Consumption (kWh) 2011 196,800 189,800 187,600 192,800 204,000 183,800
Natural Gas Cost ($) 2011 $6,146.54 $5,556.68 $5,015.30 $3,292.82 $1,525.44 $1,428.90
Consumption (CCF) 2011 5,276 4,782 4,331 2,914 1,362 1,299
No 2 Fuel Oil Cost ($) 2011 $16,231.03 $11,166.71 $8,587.05 $5,077.59 $534.92 $43.09
Consumption (CCF) 2011 14,260 10,279 8,478 5,237 562 400
Water & Sewer Cost ($) 2011 $12,320.06 $12,320.06 $11,741.82 $11,741.82 $11,741.82 $16,794.47
Consumption (GAL) 2011 2,210,986 2,210,986 2,107,257 2,107,257 2,107,257 3,013,644
Alternative Energy Cost ($) 2011 $1,914.90 $2,035.80 $2,571.40 $2,394.60 $2,012.40 $25,071.20
Consumption (CCF) 2011 1,473,000 1,566,000 1,978,000 1,842,000 1,548,000 229,400
Other - Propane Cost ($) 2011 $1,070.30 $1,535.60 $2,324.30 $3,180.10 $2,017.40 $1,923.90
Consumption (GAL) 2011 973,000 1,396,000 2,113,000 2,891,000 1,834,000 1,749,000
Total Utility Cost 2011 $55,867.15 $52,107.31 $49,487.63 $45,391.09 $38,762.38 $65,259.00
Treatment Volume (MGAL) 2011 112.240 107.500 116.700 119.400 111.200 94.700
Utility Cost/Treatment Volume ($/MG $497.75 $484.72 $424.06 $383.37 $348.58 $689.11
Electric Utilization (kWh/MGAL) 2011 1,753.39 1,765.58 1,607.54 1,628.38 1,834.53 1,940.87
2010
Electric ($/kWh) $0.1020
Natural Gas ($/CCF) $1.0894
No 2 Fuel Oil ($/CCF) $1.0610
Water/Sewer ($/GAL) $0.0056
Alt. Energy: ($/CCF
2010
January February March April May June July August September October November December
Electricity Cost ($) 2010 $16,711.68 $17,684.94 $15,451.56 $15,268.68 $16,374.96 $18,996.48 $19,939.92 $18,041.58 $17,689.84 $18,057.60 $17,876.28 $18,335.72
Consumption (kWh) 2010 163,200 172,200 150,600 149,400 159,600 174,600 182,600 177,400 173,600 182,400 186,600 190,600
Natural Gas Cost ($) 2010 $5,571.01 $5,059.70 $6,072.54 $3,619.31 $1,307.83 $1,207.72 $1,188.00 $888.13 $1,018.35 $1,324.23 $2,209.15 $6,538.90
Consumption (CCF) 2010 4,918 4,659 5,769 3,601 1,276 1,108 1,080 875 930 1,193 1,955 5,686
General Information
Building 1 Data
Building 2 Data
Building 3 Data
Building 4 Data
Building 5 Data
Building 6 Data
Building 7 Data
Ready
80%

DISTRIBUTION OF ELECTRICAL ENERGY USE & COST BY MAJOR PROCESS FOR 7/2010 - 6/2011



Major Process/Top Energy Use Systems	Electric Energy Use (%)	Electric Energy Use (kWh)	Electric Energy Cost ($)
#1 SECONDARY TREATMENT	64.60%	1,452,103	$146,953
#2 FIXED FILM TREATMENT	10.62%	238,639	$24,150
#3 ANAEROBIC DIGESTION	5.88%	132,289	$13,388
#4 LIGHTING	4.98%	111,865	$11,321
#5 PRIMARY TREATMENT	4.89%	109,930	$11,125
Balance of Plant Identified	8.51%	191,404	$19,370
Balance of Plant Unidentified	0.52%	11,770	$1,191
Total	100.00%	2,248,000	$227,497

EQUIPMENT INVENTORY: BREAKDOWN OF ELECTRICAL ENERGY USE FOR MAJOR/ENERGY INTENSIVE EQUIPMENT

Major Process/Top Energy Use Systems	Motor Efficiency (%)	Efficiency Rating	Electric Energy Use (%)	Electric Energy Use (kWh)	Electric Energy Cost ($)
Anaerobic Digestion					
Mixer - Gas Mixer	88	Medium	2.48%	55,696	$5,636.40
Other kW Load - Mixer Heater	N/A	N/A	0.80%	18,000	$1,821.60
Pump - Ht Wtr Pumps	85	Medium	0.56%	12,581	$1,273.16
Pump - Sludge Ht Wtr Pumps	85	Medium	0.62%	13,979	$1,414.63
Pump - Sludge Recir Pump	85	Medium	1.43%	32,034	$3,241.85
Effluent Pumping/Storage					
Pump - Effluent Pumps	91	High	0.91%	20,363	$2,060.77
Fixed Film Treatment					

Building 6 Data | Building 7 Data | Building 8 Data | Building 9 Data | Building 10 Data | WWTP Energy Usage | Summary Report

Result is a report format for the utility to share with decision makers

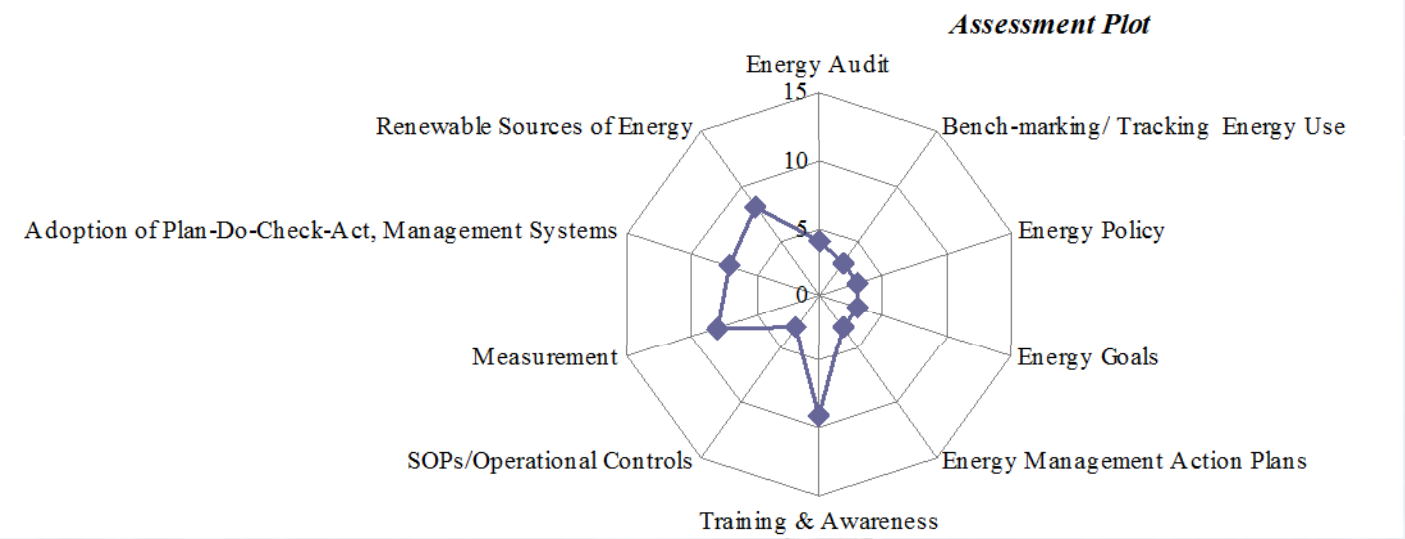
Current Status of the Tool

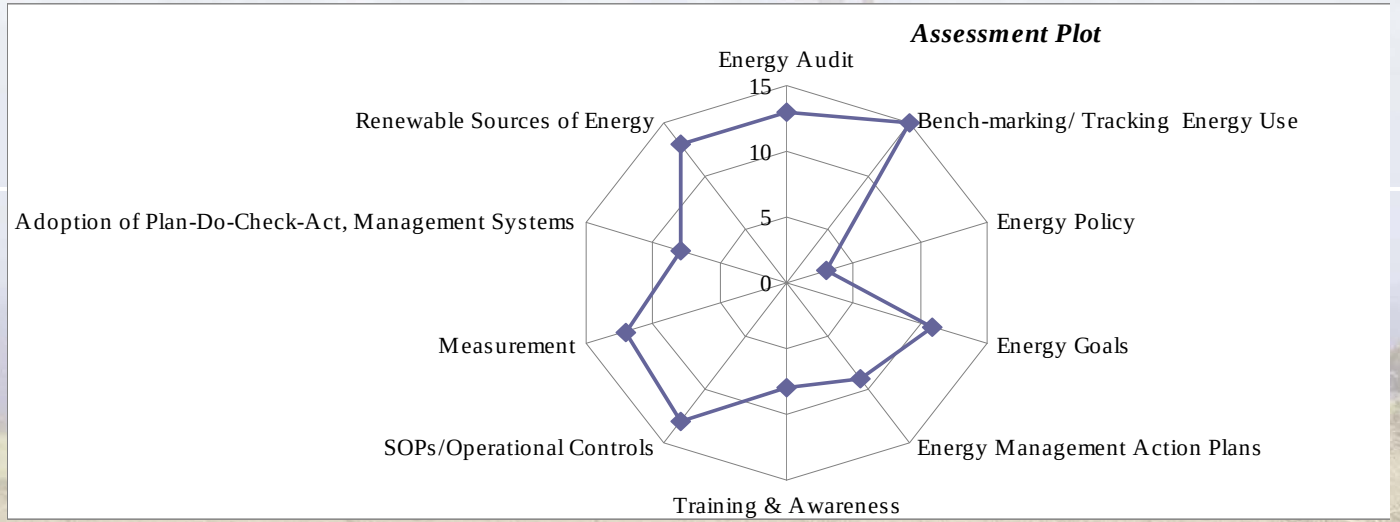
- The tool has been beta tested
- A User's Guide has been developed
- It is available for pilot use!
  - We'd like to hear from those using the tool to help develop outreach materials
  - Expect to start widespread marketing roll-out in Spring 2012
- If you're interested in piloting the Tool, email EnergyUseTool@epa.gov

EPA Energy Management Planning Self-Assessment Worksheet

- Standalone worksheet included in “Ensuring a Sustainable Future” guidebook.
- 30 questions quickly allow users to evaluate strengths and weaknesses in existing energy management plans across 10 areas
- Intended to be used periodically to check progress on PDCA cycle
- Available on request: turgeon.jason@epa.gov

Before & After Roundtables: Town A



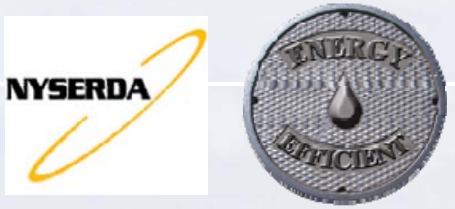


Non-EPA Energy Self-Assessment Tools

- NYSERDA Water and Wastewater Focus Program
  - Wastewater Benchmarking Tool
  - Water and Wastewater Self-Audit checklists
- CEE Water and Wastewater Self-Audit Checklists
- WERF Carbon Heat Energy Analysis Plant Evaluation Tool (CHEApet)
  - For WERF members only
- Mass Energy Insight (available to local governments in Massachusetts)

NYSERDA Water Energy Program

- Water and Wastewater Focus Program:
  - Water and Wastewater Best Practices Handbook
  - 10 Steps to Energy Efficiency for Water and Wastewater Treatment Facilities
  - Payback Analysis Tool
  - Wastewater Check List
  - Wastewater Benchmarking Tool
  - Water Treatment Check List
  - Water Treatment Benchmarking Tool
  - www.water.nyserda.org



Courtesy Nabeel Mishalani, Hazen and Sawyer

NYSERDA Energy Benchmarking Tools

- Excel-based tools specific to water or wastewater
- More involved data entry, but still simple and quick
  - Location
  - Flow
  - Water/wastewater specific process questions
  - Energy meters (electricity + 1 other fuel)
- Output
  - Tabular and graphical
  - Internal & External Benchmarking re: flow & BOD

Adapted from Nabeel Mishalani, Hazen and Sawyer

NYSERDA Energy Benchmarking Tool

EXTERNAL BENCHMARKS FOR ELECTRICITY USAGE

Comparison of Electric Energy Use for Secondary Treatment Technologies
Flow Based

Size Category	Activated Sludge (kWh/MG)	Fixed Film (kWh/MG)	Lagoons (kWh/MG)
Less than 1 MGD	4,100	3,600	2,530
1 to 5 MGD	1,340	1,380	2,170 [1]
5 to 20 MGD	1,570	1,140	Not Applicable
20 to 75 MGD	1,630	1,060	Not Applicable
Greater than 75 MGD	1,070	Not Applicable	Not Applicable

YEAR 1	YEAR 2
Compare your plant: (kWh/MG)	Compare your plant: (kWh/MG)
2,103	2,040

Table from: Statewide Assessment of Energy Use in New York Water and Wastewater Sector

Comparison of Electric Energy Use For Secondary Treatment Technologies
BOD Loading Based

Size Category	Activated Sludge (kWh/lb BOD)	Fixed Film (kWh/lb BOD)	Lagoons (kWh/lb BOD)
Less than 1 MGD	4.1	3.3	1.5
1 to 5 MGD	2.2	1.1	1.1
5 to 20 MGD	1.7	1	Not Applicable
20 to 75 MGD	1.3	1.2	Not Applicable
Greater than 75 MGD	2	Not Applicable	Not Applicable

YEAR 1	YEAR 2
Compare your plant: (kWh/lb BOD)	Compare your plant: (kWh/lb BOD)
1.03	1.10

Table from: Statewide Assessment of Energy Use in New York Water and Wastewater Sector

EXT BENCHMARKS

Courtesy Nabeel Mishalani, Hazen and Sawyer

NYSERDA Self-Audit Checklists

- Designed for small water and wastewater facilities
- Simple Yes/No questions designed to point to opportunities for efficiency in operation and equipment

SMALL WASTEWATER TREATMENT PLANT CHECKLIST

(If any are not applicable, do not provide a response for that particular question)

	YES	NO	Additional comments and information
1. INFLUENT/EFFLUENT PUMPING			
A. Do you have influent and/or effluent pumps?			
B. If yes, do you have variable speed control on the influent pumps?			
C. If yes, are premium-efficiency motors currently installed on the influent pumps?			
D. If yes, do you have variable speed control on the effluent pumps?			
E. If yes, are premium-efficiency motors currently installed on the effluent pumps?			
Subtotal Grayed			
2. PRE-AERATION/POST-AERATION			
A. Does your plant utilize aeration blowers/compressors for preaeration, post-aeration or other aerated channels?			
B. If yes, are there currently means to throttle the amount of air delivered or otherwise adjust output?			
Subtotal Grayed			
3. INTERMEDIATE PUMPING			
A. Do you have intermediate pumps to convey flow from primary to secondary processes or from secondary to tertiary treatment processes?			
B. If yes, do you have variable speed control on the intermediate pumps?			
C. If yes, are premium-efficiency motors currently installed on the intermediate pumps?			
Subtotal Grayed			
4. BIOLOGICAL PROCESSES - ACTIVATED SLUDGE PROCESSES			

CEE Self-Audit Checklists

- Adapted from NYSERDA Checklists
- Designed for small water and wastewater facilities
- Simple Yes/No questions designed to point to opportunities for efficiency in operation and equipment
- Available through CEE partners (e.g., Efficiency Vermont)

WERF CHEApet

- Carbon Heat Energy Analysis Plant Evaluation Tool (CHEApet)
- Web-based plant-wide energy model
- " …tool to assist with screening and selection of alternatives … can also be used for preliminary analysis of relative sources and consumptions of energy that affect the estimated carbon footprint."
- Free to Water Environment Research Foundation members

Courtesy Nabeel Mishalani, Hazen and Sawyer

Mass Energy Insight

- Available to any Massachusetts government entity including water/wastewater districts
- Data automatically uploaded from electric/gas utilities
- Provides a variety of built-in reports for water/wastewater industries
- Ability to interface automatically with ENERGY STAR Portfolio Manager
- www.massenergyinsight.net/

Section 2: Energy Audits

- Conducted by outside experts
- Available in a variety of costs from free to high 5 figures
- Available in a variety of levels from walk-through to “investment-grade”

Image: CC-licensed by kqedquest http://flic.kr/p/KyS8o

Energy Audits

- Types of Audits
- Costs & Providers
- Results
- Examples

Energy Audits

- Typically identify capital improvements (motors, blowers, variable frequency drives, etc) and operational improvements
- Operational improvements can result in substantial savings with little to no cost
  - Time of operation, load demand contracts, unnecessary equipment, energy management systems, etc.
- Audits can be conducted on plant designs – very cost effective
- Can identify renewable energy opportunities

Types of Energy Audits
DEMAND vs SUPPLY

- ASHRAE Tiered Energy Audits
  - Level I (Walk-Through Analysis)
  - Level II (Energy Survey & Analysis)
  - Level III (Detailed Analysis of Capital – Intensive Modifications, aka Process Audit)
- Renewable Energy Assessments
  - Simple Discussion of Alternatives
  - Desktop Analysis
  - Feasibility Study

EPA Goals:
Address Both Demand & Supply

- All facilities will benefit from Level II or Level III audit
  - Uncover operational and equipment changes for efficiency
  - These audits are NOT free, but have very fast paybacks
- All facilities should discuss renewable energy options and have a desktop analysis of promising alternatives
  - Feasibility studies performed where potential exists for significant energy production
- All facilities should use BOTH to develop a prioritized action list to guide their next steps!

Other names/types of audits

- Evaluate existing power consumption and metrics
  - Utility bill analysis
  - Benchmarking
- HVAC/Mechanical system audit
  - Evaluate gas requirements (process & heating systems)
  - Evaluate ventilation (efficiency & effectiveness)
  - Controls (programmable thermostats, etc.)
- Electrical system audit
  - Motor efficiency / type
  - Variable frequency drives
  - Lighting (systems, bulb type, controls)
- Process system audit
  - Process improvement
  - Operations optimization
  - Efficiency planning

The Auditor's Toolkit

- Building Loads Analysis and Systems
- Steam System Scoping Tool
- GENLYTE GENESIS II
- COM Check-E2 3.0 Release I
- Motor Master + 3.0
- Pumping Assessment Tool (PSAT)
- AIR Master +
- InfoWater Scheduler
- ENERGY STAR Portfolio Manager
- eQuest
- Elite CHVAC
- 3E Plus
- SKM Power Tools
- Cummins Power Generation Power Suite
- Caterpillar Electric Power Design Pro
- NYSERDA Checklists
- EPA audit tool

Important Terms in Utility-Funded Audits

- Utility = Not you! The energy (electric or gas) provider.
- PA = Program Administrator = Utility Energy Efficiency personnel. Your new best friend - can help pay for audits and provide incentives ($$$) for projects!
- Identification of Energy Efficiency Opportunities = ~ Level I audits

Audit Costs and Providers

- PAs can and will fund audits in many service territories across the country
  - Audit costs usually split 50/50
  - You may be able to negotiate with PAs to develop something that works for you
  - PAs will often do a free walk-through with a simple checklist (aka Identification of EE Opportunities)

Audit Costs and Providers (cont'd)

- Find your PA by contacting your utility or visiting www.dsireusa.org and selecting your state.
- Some states have state-run efficiency programs instead of utility contacts (VT, WI, OR, ME, NY, NJ) but your utility can always tell you who to contact
- Some utilities, especially when owned by a municipality, may not offer assistance
- US DOE funds a network of Industrial Assessment Centers (IACs). Some IACs will work with water/wastewater clients at no cost.

  www1.eere.energy.gov/industry/bestpractices/about_iac.html

Audit Costs and Providers (cont'd)

- Most PAs have auditors under contract for Level II audits
  - Still require cost-share, but usually less expensive than specialists. Usually ~ $10,000 (often split 50/50)
  - Not likely to do any renewable energy work
  - Usually do not provide plant energy balance
  - Varying levels of experience depending on contractor
- PAs **may** fund specialist auditors for Level III/process audits
  - Costs vary by plant size, from $8-60,000 (often split 50/50)
  - You need to demonstrate willingness/ability to implement projects
  - Auditors may or may not look at renewables
  - Auditors should provide a plant energy balance

Walk Through Audit (ASHRAE Level I)

- DURATION: Several hours in the facility
- PRODUCT: Usually suggestions for low cost improvements to lights/HVAC
- RESULTS: Quick payback projects that take advantage of utility rebates

Energy Survey and Analysis (ASHRAE Level II)

- DURATION: Several hours in facility plus additional time to review energy bills, etc.
- PRODUCT: Suggestions for low cost improvements to lights/HVAC **and** equipment upgrades in existing processes (e.g., VFDs, premium efficiency motors)
- RESULTS: Quick payback projects that take advantage of utility rebates

Process Energy Audit (ASHRAE Level III)

- DURATION: One or more days in the facility, time to analyze energy bills, develop pump curves, and possibly several weeks of data gathering
- PRODUCT:
  - Energy use in existing processes, alternative processes
  - Potential design modifications
  - Optimization of processes, equipment, design modifications
- RESULTS: Detailed operational and process suggestions with both short and long paybacks, some capital-intensive projects may require outside funding sources. Most likely to result in significant savings

Renewable Energy Assessments

- Start small (discussion) and end large ($100k+ feasibility studies)
- Some energy auditors will do some level of renewable energy assessment, usually discussion and desktop analysis with recommendations for further study
- Renewable energy projects usually only cost-effective AFTER all energy efficiency projects are completed.
- Some states have programs to fund assessments for certain types of projects

Audit Results:
One Size Does Not Fit All

FACILITY NAME	**AUDIT TYPE, LENGTH**	**AUDIT COST** (free audits no longer standard)	**ANNUAL ENERGY COST**	**ANNUAL SAVINGS**
Barnestable	Level I-II, 8 pgs	Free via utility	Not calculated	$32,422
Edgartown (audit 1)	Level II, 56 pgs	Free via utility	$209,328	$17,728
Edgartown (audit 2)	Level II, 170 pgs w/specs	Free via utility	Not calculated	$42,082
GLSD	Level III, 117 pgs	~$50,000 (split with utility)	$3,286,000	$1,028,000
Name Withheld (CT Water Facility)	Level III plus Desktop Renewables	~$25,000	$319,000	$55,000 efficiency, additional potential from up to 530 KW renewables

Two types of audits

	Projected Annual Savings	
	Level II Building and Equipment Walkthrough	Level III (Process) Audit
Shut off computers, copiers nights/weekends	$600	$600
Use Energy saver mode on Computers, copiers	$250	$250
Lighting upgrades	$500	$500
Upgrade Domestic HW system	$2,000	$3,000
Install VFD on aeration blowers	$20,000	
Redesign Aeration system, install DO controls		$50,000

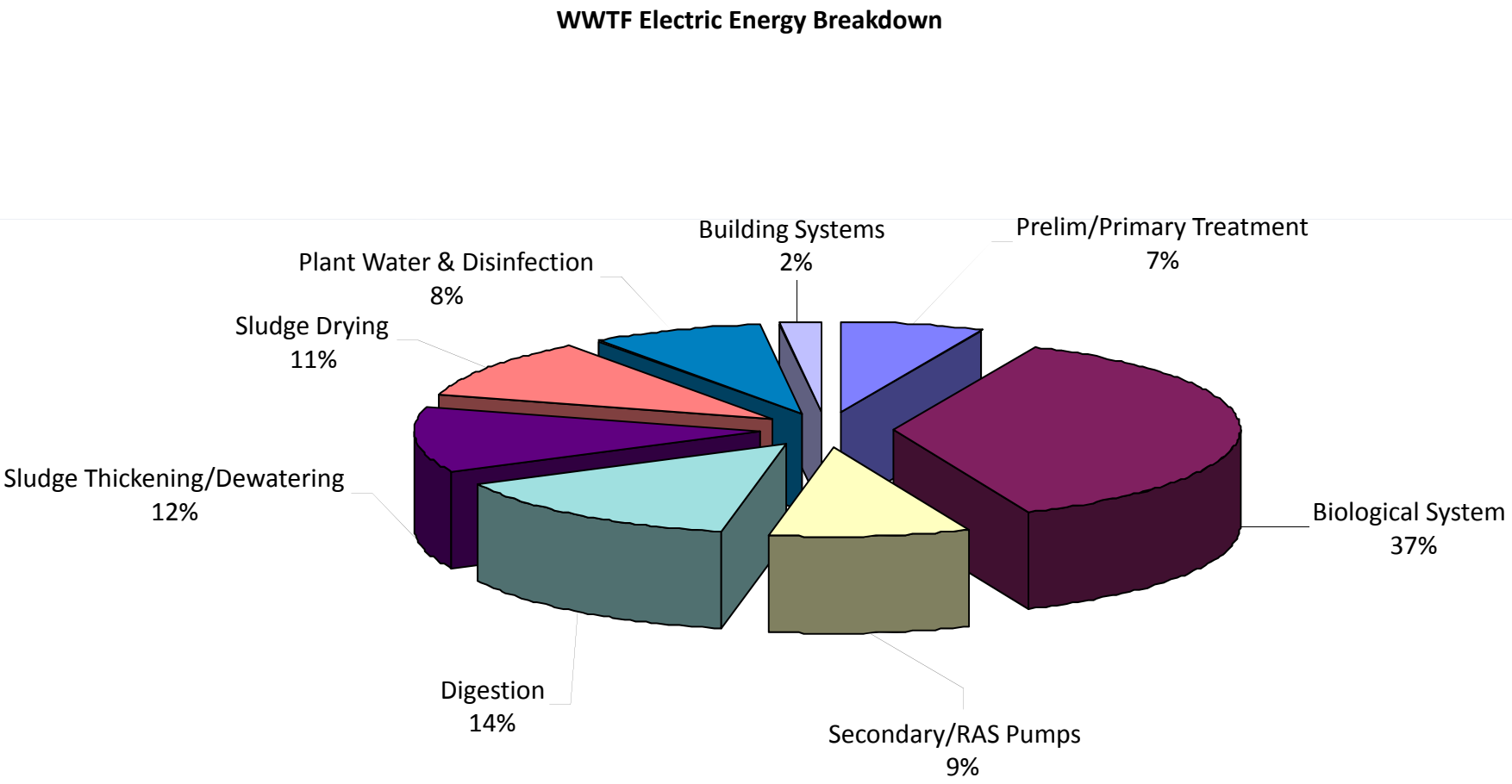
Level II audit results

- Estimates of power usage by equipment type
- No detailed analysis of equipment specs and performance
- Estimates of implementation cost and payback
- Simple low cost solutions but less savings

Level III (Process) Audit Results

- Process Energy Audit report includes:
  - Review of energy use and rates
  - Energy balance
  - Pump systems evaluation
  - Process systems evaluation
  - Recommendations: Operational & Energy Conservation
  - Cost benefit analysis of proposed projects
  - Higher cost savings

Energy Balance example



RECOMMENDED COST SAVING PROJECTS

	Cost Saving Measures	Annual Savings	Project Cost	Simple Payback (yrs)
	OPERATIONAL MEASURES			
OM 1	Initiate an efficiency management program	--	--	--
OM 2	Reduce use of channel blower	$4,704	$2,000	--
OM 3	Adjust raw sewage pump level set point	$2,052	--	--
OM 4	Discontinue use of dewatering pump	$5,031	--	--
OM 5	Blower system adjustments	$12,841	--	--
OM 6	Discontinue using blower air for off-line tank	$12,482	--	--
OM 7	Partial nitrification from November to March	$3,755	--	--
	ENERGY CONSERVATION MEASURES			
ECM 1	Install demand controls	$5,176	$34,500	6.7
ECM 2	Replace plant water pump motor	$659	$2,527	3.8
ECM 3	Improve plant water system controls	$5,628	$7,500	1.3
ECM 4	Heating system improvements	--	$9,600	1.3
	Potential Energy Program Cost and Savings	**$52,925**	**$52,127**	**1 year**

Review

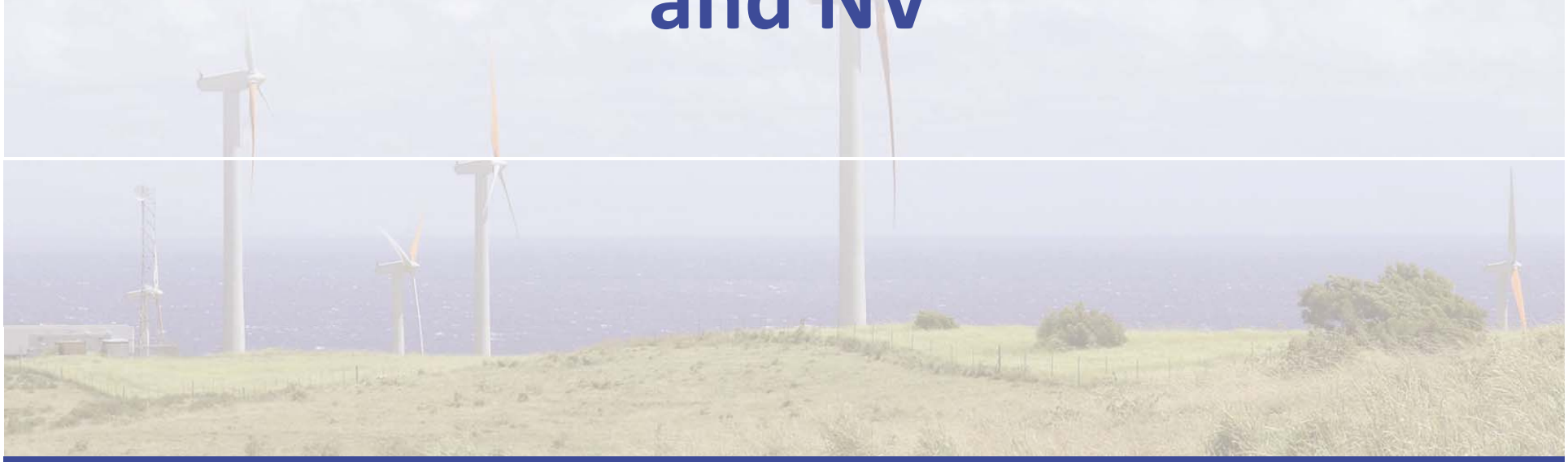
- All facilities will benefit from an audit
- Audits vary in size, scope, complexity, and cost
- PAs will help you fund audits and projects
- Renewable energy assessments are important but should come after efficiency projects
- Audits that don’t lead to completed projects don’t save any energy!

Two Tools to Help with Audits

- Maine DEP Sample Audit RFP Language
  - MS Word based to allow for easy cut-and-paste
  - Designed to incorporate most important elements of Level III audits at lowest cost
  - Available on request: turgeon.jason@epa.gov
- EPRI Energy Audit Manual for Water/WW Facilities
  - Older (1994) but still relevant
  - www.cee1.org/ind/mot-sys/ww/epri-audit.pdf

Questions

Section 3:
Evaluation of Energy Audit Pilot Program Results in AZ, CA, HI, and NV



EPA Region 9's Auditing Pilot Program

- Water and wastewater utilities that received ARRA funding were eligible to receive Level II/III energy audits…15 were selected
- Draft results show recommendations with a maximum 7.5 yr payback have potential:
  - $1.4 million/yr cost savings with a 4.5 yr payback (16% ROI)
  - 6,900 megawatt hours/yr reductions

EPA Region 9's Auditing Pilot Program

- 15 **draft** recommendations with <1 yr payback period, with total annual savings of $190K/yr (**>100% ROI**)
- Non-capital improvements such as rate modifications, time-of-use, depowering equipment, and shutting down unnecessary processes
- These could likely be identified with low cost self-assessments or walk-through audits

EPA Region 9's Auditing Pilot Program

- **Draft** recommendations identified an average:
  - 17% savings in energy **use**
  - 26% savings in energy **costs**
- Critical to note these audits were not prioritized to "ideal" candidates due to limited duration of funding
- Interestingly, no statistical differences between small and large utility results

Lessons Learned – Audit Process

- Target proper level of audit
- Discuss your payback period thresholds with auditor
- Request an initial simple draft report with brief summary of recommendations
- Discuss draft report with contractor to determine where further detail is required
- Leads to an effective final report…expensive contractor time not wasted on unwanted info

Renewable Energy Assessment Highlight

- Wastewater treatment plant
- Potential savings of $650K/yr and 4 megawatt hours/yr with a 5.7 year payback through addition of a cogeneration facility
- Potential for no capital cost to implement this renewable energy project if a Power Purchase Agreement used (prelude to a webinar later in this series)

Section 4: Suggested Next Steps

- Conduct a Self-Assessment (including benchmarking) of your utility's energy use
  - This is a critical, low-to-no cost step towards energy management
- Conduct a Level II or III energy audit at your facility
- Begin implementing an energy management program to implement audit recommendations

Resources for Funding Audits

- Add an energy audit on to your next capital improvement project grant/loan/bond (or amend scope of existing project)
- Your energy provider (incentives on DSIRE: www.dsireusa.org)
- List of federal/state programs soon to be posted on Region 9 EPA's website (http://www.epa.gov/region9/waterinfrastructure)
- Your utility operations budget

Questions

Contact Information

- Jim Horne, EPA Office of Wastewater Management
  - horne.james@epa.gov (202) 564-0571
- Jason Turgeon, EPA Region 1
  - turgeon.jason@epa.gov (617) 918-1637
- Eric Byous, EPA Region 9
  - byous.eric@epa.gov (415) 972-3531

Participation Certificate

- If you would like to obtain participation certificates for multiple attendees, type the link below into your web browser
- You can type each of the attendees' names in and print the certificates www.epa.gov/npdes/webcasts/certificate/energymanagementcert120111.pdf